M = Mid-ordinate, in meters
Z = Any tangent offset, in meters
L = Horizontal length of vertical curve, in meters
X = Horizontal distance from PVC or PVT to any ordinate "Z," in meters
G_1 & G_2 = Rates of grade, expressed algebraically, in percent

ALL EXPRESSIONS TO BE CALCULATED ALGEBRAICALLY

$$ELEV.\ \ OF\ \ PVI\ = ELEV.\ \ PVC\ + G_1 \frac{L}{200}$$

$$ELEV.\ \ OF\ \ PVT\ = ELEV.\ \ PVC\ + (G_1 + G_2)\frac{L}{200}$$

$$Mid\ -ordinate\ \ distance\ \ "M"\ in\ meters\ = \frac{(G_2 - G_1)}{800} L = \frac{1}{2}\left(\frac{ELEV.\ \ OF\ \ PVC\ + ELEV.\ \ OF\ \ PVT}{2} - ELEV.\ \ PVI\right)$$

For offset "Z" at distance "X" from PVC or PVT:

$$Z = M\left(\frac{X}{L/2}\right)^2 \quad or \quad Z = \frac{X^2 (G_2 - G_1)}{200\ L}$$

$$S,\ in\ \ percent\ \ = G_1 - \left[X\left(\frac{G_1 - G_2}{L}\right)\right]$$

For slope "S" of a line tangent to any point on the vertical curve at an "X" distance measured from the PVC:

CALCULATING HIGH OR LOW POINT ON CURVE

$$X_T = \frac{LG_1}{G_1 - G_2}$$

Where "X_T" equals the horizontal distance from the PVC to the high or low point on the curve in meters.
Elevation of high or low point on curve equals:

$$ELEV.\ \ PVC\ - \frac{LG_1^2}{(G_2 - G_1)\ 200}$$

SYMMETRICAL VERTICAL CURVE EQUATIONS
Figure 44-3F